

FORM PTO-1390 (Modified) (REV 10-95)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				1787	
				U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 09/980991)	
INTERNATIONAL APPLICATION NO. PCT/DE 00/01342		INTERNATIONAL FILING DATE APRIL 28, 2000		PRIORITY DATE CLAIMED JUNE 19, 1999	
TITLE OF INVENTION PIEZOELECTRIC ELEMENT WITH A MULTI-LAYER STRUCTURE OF PIEZOELECTRIC PLIES, AND A METHOD FOR PRODUCING IT					
APPLICANT(S) FOR DO/EO/US Bertram SUGG, Friedrich BOECKING					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
<ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). 4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371 (c) (2)) <ol style="list-style-type: none"> a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). 7. <input checked="" type="checkbox"/> A copy of the International Search Report (PCT/ISA/210). 8. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3)) <ol style="list-style-type: none"> a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 9. <input checked="" type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 10. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)). 11. <input checked="" type="checkbox"/> A copy of the International Preliminary Examination Report (PCT/IPEA/409). 12. <input checked="" type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)). 					
Items 13 to 18 below concern document(s) or information included:					
<ol style="list-style-type: none"> 13. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 14. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 15. <input checked="" type="checkbox"/> A FIRST preliminary amendment. A SECOND or SUBSEQUENT preliminary amendment. 16. <input type="checkbox"/> A substitute specification. 17. <input type="checkbox"/> A change of power of attorney and/or address letter. 18. <input checked="" type="checkbox"/> Certificate of Mailing by Express Mail 19. <input type="checkbox"/> Other items or information: 					
ET 755324623 US					

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

INTERNATIONAL APPLICATION NO.

ATTORNEY'S DOCKET NUMBER

09/980991

PCT/DE 00/01342

1787

20. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

- ☐ Search Report has been prepared by the EPO or JPO **\$930.00**
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) **\$720.00**
- ☐ No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) **\$790.00**
- ☒ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO **\$1,070.00**
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) **\$98.00**

ENTER APPROPRIATE BASIC FEE AMOUNT =**CALCULATIONS PTO USE ONLY****\$890.00**Surcharge of **\$130.00** for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492 (e)).☐ 20 ☐ 30**\$0.00**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	8 - 20 =	0	x \$18.00
Independent claims	1 - 3 =	0	x \$80.00

\$0.00**\$0.00**

Multiple Dependent Claims (check if applicable).

☐**\$0.00****TOTAL OF ABOVE CALCULATIONS =****\$890.00**

Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable).

☐**\$0.00****SUBTOTAL =****\$890.00**Processing fee of **\$130.00** for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492 (f)).☐ 20 ☐ 30

+

\$0.00**TOTAL NATIONAL FEE =****\$890.00**

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).

☒**\$40.00****TOTAL FEES ENCLOSED =****\$930.00**

Amount to be:

refunded

\$

charged

\$

☐ A check in the amount of to cover the above fees is enclosed.

☒ Please charge my Deposit Account No. **19-4675** in the amount of **\$930.00** to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **19-4675** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

STRIKER, STRIKER & STENBY
103 EAST NECK ROAD
HUNTINGTON, NEW YORK 11743

SIGNATURE

MICHAEL J. STRIKER

NAME

27233

REGISTRATION NUMBER

DECEMBER 6, 2001

DATE

UNITED STATES PATENT AND TRADEMARK OFFICE

Docket No.: 1787

In re:

Applicant: SUGG

Serial No.:

For: PIEZOELECTRIC ELEMENT
WITH A MULTILAYER...

SIMULTANEOUS AMENDMENT

December 5, 2001

Hon. Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sir:

Simultaneously with filing of the above identified application,
please amend the same as follows:

09/980991

JC10 Rec'd PCT/PTO 0 6 DEC 2001

In the specification:

Please amend the specification as attached.

In the claims:

Cancel all claims without prejudice.

Add the claims as attached.

REMARKS

This Amendment is submitted simultaneously with filing of the above identified application.

With the present Amendment applicants have amended the specification to bring it in compliance with the requirements of the U.S. Patent Practice.


The original claims have been canceled and replaced with a new set of claims.

Consideration and allowance of present application is most respectfully requested.

Should the Examiner require or consider it advisable that the specification, claims and/or drawings be further amended or corrected in formal respects in order to place this case in condition for final allowance, then it is respectfully requested that such amendments or corrections be carried out by Examiner's Amendment, and the case be passed to issue. Any costs involved should be charged to the deposit account of the

undersigned (No. 19-4675). Alternatively, should the Examiner feel that a personal discussion might be helpful in advancing this case to allowance, he is invited to telephone the undersigned (at 631-549-4700).

Respectfully submitted,

A handwritten signature in black ink, consisting of a stylized 'M' followed by a horizontal line that curves upwards at the end.

Michael J. Striker
Attorney for Applicants
Reg. No. 27233

In the specification:

**Page 1, line 4, change the heading "Prior Art" to --
Background of the Invention --.**

**On page 1, please amend the first paragraph on lines 6-9
as follows:**

The invention concerns a piezoelectric element with a multilayer structure of piezoelectric piles and a method for producing it, e.g., for a piezoelectric actuator for actuating a mechanical component such as a valve or the like[, according to the features-based on the general class-of the primary claim].

**Page 1, line 24, replace the heading "Advantages of the
Invention" to -- Summary of the Invention --.**

After this heading please insert :

-- In keeping with these objects and with others which will become apparent hereinafter, one feature of the present invention resides,

briefly stated, in a piezoelectric element, comprising a multilayer structure of piezoelectric plies; said internal electrodes arranged between said piezoelectric plies; a lateral contacting of said internal electrodes in alternate directions via external electrodes, said piezoelectric plies individually being composed of a continuous film that is foldable during manufacture and provided at least partially with said electrodes which are electrically conductive, said film being at least partially metalized to produce said electrodes, said piezoelectric plies being formed by folding at notches applied at specific intervals transversely to a direction of folding, said internal electrodes are formed by metalized layers lying on an inside of the notches after the folding, and said metalized layers being interrupted on an outside of the notches, said internal electrodes being contacted with said external electrodes on insides of said notches projecting outwards after the holding. --

**On page 3, line 26, change the heading “Diagram” to --
Brief Description of the Drawings --.**

**On page 4, line 8, change the heading “Description of the
Exemplary Embodiment” to -- Description of the Preferred
Embodiments --.**

CLAIMS

New claims:

9. A piezoelectric element, comprising a multilayer structure of piezoelectric plies; internal electrodes arranged between said piezoelectric plies; a lateral contacting of said internal electrodes in alternate directions via external electrodes, said piezoelectric plies individually being composed of a continuous film that is foldable during manufacture and provided at least partially with said electrodes which are electrically conductive, said film being at least partially metalized to produce said electrodes, said piezoelectric plies being formed by folding at notches applied at intervals transversely to a direction of folding, said internal electrodes being formed by metalized layers lying on an inside of the notches after the folding, and said metalized layers being interrupted on an outside of the notches, said internal electrodes being contacted with said external electrodes on insides of said notches projecting outwards after the folding.

10. A piezoelectric element as defined in claim 9, wherein only every other surface between the notches is metalized at least on one side of side film.

11. A piezoelectric element as defined in claim 9, wherein said external electrodes are composed of an electrically conductive material selected from the group consisting of a screen and a net.

12. A piezoelectric element as defined in claim 9, wherein said external electrodes are wave electrodes.

13. A piezoelectric element as defined in claim 9, wherein said multilayer structure of said piezoelectric plies is provided with an electrically insulating ceramic plate at each end of said folded plies.

14. A piezoelectric element as defined in claim 9, wherein the piezoelectric element is formed as a component of a piezoelectric actuator which is usable to actuate a mechanical component.

15. A piezoelectric element as defined in claim 9, wherein the piezoelectric element is formed as a component of a piezoelectric actuator which is usable to actuate a mechanical component which is a valve.

16. A method of producing a piezoelectric element having a multilayer structure of piezoelectric plies, comprising the steps of cutting a

piezoelectric film to a width of the piezoelectric element and providing the cut piezoelectric film with notches at intervals always in alternate directions; metalizing the piezoelectric film at least partially on both sides; folding the piezoelectric film at the notches around an inside of the notch; applying external electrodes by soldering to an internal electrode in a bending region, in the inside of the notch projecting outward after the folding.

17. A method as defined in claim 16; and further comprising installing on external piezoelectric plies before sintering an electrically insulating head and foot plate composed of piezoelectric ceramic.

1 PIEZOELECTRIC ELEMENT WITH A MULTILAYER STRUCTURE OF
2 PIEZOELECTRIC PLIES, AND A METHOD FOR PRODUCING IT

3
4 Prior Art

5
6 The invention concerns a piezoelectric element with a multilayer structure of
7 piezoelectric plies and a method for producing it, e.g., for a piezoelectric actuator
8 for actuating a mechanical component such as a valve or the like, according to
9 the features—based on the general class—of the primary claim.

10
11 It is generally known that, by utilizing the “piezoelectric effect”, a piezoelectric
12 element can be constructed of a material having a suitable crystal structure.
13 When an external electrical voltage is applied, a mechanical reaction of the
14 piezoelectric element takes place that, depending on the crystal structure and the
15 application regions of the electric voltage, represents a push or pull in a
16 specifiable direction. The construction of this piezoelectric actuator can take
17 place here in a plurality of layers (multilayer actuators), and the electrodes, via
18 which the electrical voltage is applied, are always arranged between the layers.
19 The respective internal electrodes are hereby always separated from the external
20 electrodes by a space, so that a short circuit does not take place here. The
21 expense to stack the individual piezoelectric plies is thereby very high, because
22 up to many hundred individual film layers must be processed separately.

23
24 Advantages of the Invention

25
26 The piezoelectric element described initially having a multilayer structure of
27 piezoelectric plies, with electrodes arranged between them and a lateral
28 contacting of electrodes in alternate directions can advantageously be a
29 component of a piezoelectric actuator that can be used to actuate a mechanical
30 component such as a valve or the like. According to the invention, the individual
31 piezoelectric plies are composed of a continuous film made of piezoceramic that

can be folded during manufacture, that are provided entirely or partially with electrically conductive electrodes on their surface.

In a preferred embodiment, the film for producing the electrodes is entirely or partially metallized, and the piezoelectric plies are formed by means of folding at notches applied at specified intervals transverse to the direction of folding, and the internal electrodes are formed by the metallized layers between the piezoelectric plies lying on the inside of the notches after the folding, and the metallized layers on the outside of the notches are interrupted by the notches.

The metallized layers can be applied, for example, by means of printing or sputtering. The internal electrodes are thereby contacted with the external electrodes on the insides of the notches projecting outward after the folding. The notch angle α can thereby be adapted individually to the thickness of the film or other circumstances.

In advantageous fashion, only every other surface between the notches can be metallized on at least one side of the film in each case without impairing the formation of internal electrodes.

External electrodes can be applied on the outside in each case in the notch region of the folded film in simple fashion to form the contacting at the metallized layer or the internal electrode in alternate directions, and the external electrodes can be composed of an electrically conductive screen or net, or of a wave electrode.

In order to insulate the entire piezoelectric element against the outside, the multilayer structure of the piezoelectric plies is provided with an electrically insulating ceramic plate on each end of the folded plies.

In an advantageous method for producing a piezoelectric element of the type described previously, the following production steps are carried out:

- The piezoelectric film is cut to the width of the piezoelectric element and provided with notches at specified intervals, always in alternate directions.
- The piezoelectric film is now entirely or partially metallized on both sides.
- The piezoelectric film is then folded at the notches, always around the inside of the notch.
- The external electrodes are e.g., soldered to the internal electrodes in the bending region in the inside of the notch projecting outward after the folding.
- One electrically insulating head and foot plate each are applied to the external piezoelectric plies.

These and further features of preferred further developments of the invention also arise from the description and the diagrams, in addition to the claims, and each of the individual features can be realized on its own or in plurality in the form of sub-combinations in the exemplary embodiment of the invention and in other fields, and can represent advantageous and patentable embodiments in themselves, for which protection is claimed here.

Diagram

An exemplary embodiment of the piezoelectric element according to the invention for forming a piezoelectric actuator is explained using the diagram.

Figure 1 shows a sectional view through a multilayer structure of the piezoelectric element composed of a piezoelectric film, produced by folding at the notches;

Figure 2 shows a detailed view of a notched film with continuous metallizing, and

Figure 3 shows a detailed view of a notched film with partial metallizing.

Description of the Exemplary Embodiment

A piezoelement 1 for forming a piezoelectric actuator is shown in Figure 1, that is constructed of a piezoelectric film 2 of a ceramic material having a suitable crystal structure, so that, by utilizing the "piezoelectric effect", a mechanical reaction of the piezoelectric actuator takes place in the direction of the arrow 3 when an external electrical voltage is applied.

It is obvious in Figure 1 that piezoelectric plies 4 are formed by means of a folding of the piezoelectric film 2 that is shown in the state before its folding in Figure 2. The piezoelectric film 2 was cut before folding to the width of the piezoelectric element 1 and metallized on both sides so that electrodes form that, after folding, act as internal electrodes 6 and 7, each in an alternate direction.

It is shown in Figure 2 that the piezoelectric film 2 has been provided with notches 5 (i.e., 5.1, 5.2 in the sectional view shown) before folding, which are thereby created in the film 2 in alternate directions and form an approximate angle α . The folding takes place here, e.g., in the notch 5.1 around the arrow 8, so that one of the internal electrodes (e.g., the internal electrode 6) forms on the left side after the folding-on top of each other. The other internal electrodes (one of the internal electrodes 7 here) form on the right side, also on both sides of the open side of the notch 5.1 in each case.

1 After laminating and sintering, the stack of piezoelectric plies 4 folded in this
2 fashion is provided with external electrodes 9 and 10, each of which is composed
3 of a metallized wave electrode in the exemplary embodiment shown. The
4 external electrodes 9 and 10 are connected with the metallized layer on the
5 piezoelectric plies 4 in electrically conductive fashion in the respective projecting
6 folding region of the previous notches 5, so that an electrical voltage can be
7 applied to the internal electrodes 6 and 7 to create the piezoelectric effect.
8

9 Additionally, one electrically insulating head plate 11 and a foot plate 12 each are
10 applied to the external piezoelectric plies 4, by means of which the entire
11 piezoelectric element 1 can be insulated against the outside.
12

13 According to Figure 3, which shows a piezoelectric film 20 in the state before its
14 folding, only partial regions of the piezoelectric film 20 are provided with
15 electrodes 21 and 22, in contrast to the piezoelectric film 2 according to Figure 2.
16 These electrodes 21 and 22 are applied to one of the opposing sides of the
17 piezoelectric film 20 in alternate directions in each case, so that piezoelectric
18 plies 4 also form as described using Figure 1, but the resultant internal
19 electrodes 21 and 22 here have a smaller thickness, because they are formed by
20 means of a one-sided coating only.
21
22
23
24

Claims

1. Piezoelectric element with a multilayer structure of piezoelectric plies (4) having electrodes (6, 7; 21, 22) arranged between them, and having
 - a lateral contacting of the electrodes (6, 7; 21, 22) in alternate directions via external electrodes (9, 10), wherein
 - the individual piezoelectric plies (4) are composed of a continuous film (2; 20) that can be folded during manufacture, that are entirely or partially provided with the electrically conductive electrodes (6, 7; 21, 22).
2. Piezoelectric element according to Claim 1, characterized in that
 - the film (2; 20) for producing the electrodes (6, 7; 21, 22) is entirely or partially metallized, that
 - the piezoelectric plies (2; 20) are formed by folding at notches (5, 5.1, 5.2) created at specified intervals transverse to the direction of folding, wherein the internal electrodes (6, 7; 21, 22) are formed by the metallized layers lying inside the notches (5, 5.1, 5.2) after the folding, and the metallized layers are interrupted on the outside of the notches (5, 5.1, 5.2), and that
 - the internal electrodes (6, 7; 21, 22) are contacted with the external electrodes (9, 10) on the insides of the notches (5, 5.1, 5.2) projecting outward after the folding.
3. Piezoelectric element according to Claim 2, characterized in that
 - only every other surface between the notches (5, 5.1, 5.2) is metallized in each case, at least on one side of the film (20).
4. Piezoelectric element according to Claim 2 or 3, characterized in that
 - the external electrodes (9, 10) are composed of an electrically conductive screen or net.
5. Piezoelement according to Claim 2 or 3, characterized in that

- 1 - the external electrodes are composed of wave electrodes (9, 10).
- 2
- 3 6. Piezoelectric element according to one of the preceding claims,
- 4 characterized in that
- 5 - the multilayer structure of piezoelectric plies (4) is provided with an
- 6 electrically insulating ceramic plate (11, 12) on each end of the folded
- 7 plies.
- 8
- 9 7. Piezoelectric element according to one of the preceding claims,
- 10 characterized in that
- 11 - the piezoelectric element (1) is a component of a piezoelectric actuator
- 12 that can be used to actuate a mechanical component such as a valve or
- 13 the like.
- 14
- 15 8. Method for producing a piezoelectric element (1) according to one of the
- 16 Claims 2 through 7, characterized in that
- 17 - the piezoelectric film (2; 20) is cut to the width of the piezoelectric element
- 18 (1) and provided with notches (5, 5.1, 5.2) at specified intervals, always in
- 19 alternate directions, that
- 20 - the piezoelectric film (2; 20) is metallized entirely or partially on both sides,
- 21 that
- 22 - the piezoelectric film (2; 20) is folded at the notches (5, 5.1, 5.2), always
- 23 around the inside of the notch (5, 5.1, 5.2), and that
- 24 - the external electrodes (9, 10) are applied by means of soldering to the
- 25 internal electrode (6, 7; 21, 22) in the bending region, in the inside of the
- 26 notch (5) projecting outward after the folding.
- 27
- 28 8. Method according to Claim 7, characterized in that
- 29

- 1 - an electrically insulating head and foot plate (11, 12) composed of
2 piezoelectric ceramic are installed on the external piezoelectric plies (4)
3 before sintering.

4

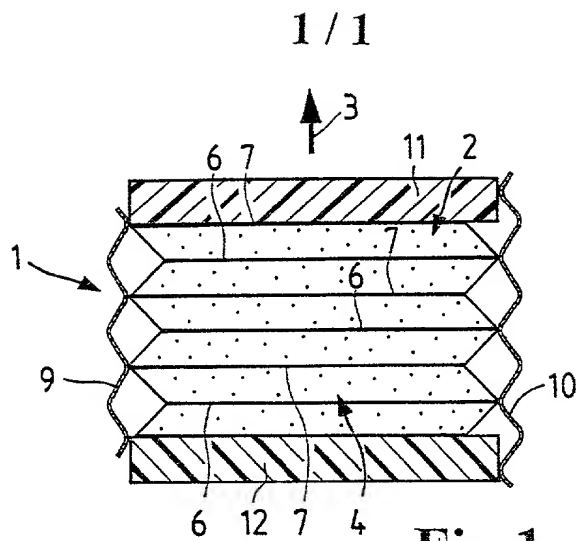


Fig.1

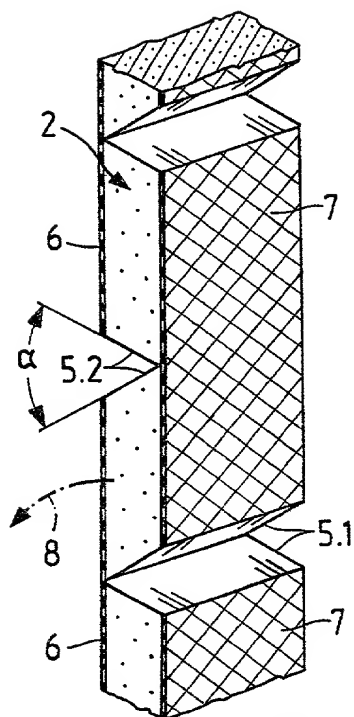


Fig.2

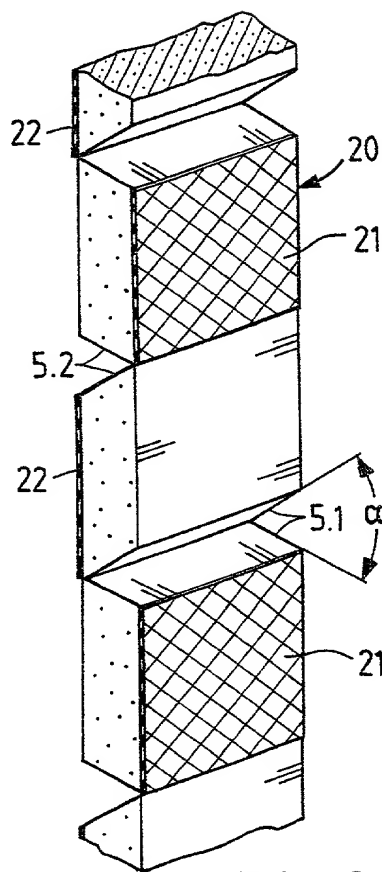


Fig.3

DECLARATION AND POWER OF ATTORNEY FOR NATIONAL STAGE OF PCT PATENT APPLICATION

As a below-named inventor, I hereby declare that:

Bertram SUGG
Friedrich BOECKING

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **PIEZOELECTRIC ELEMENT WITH A MULTI-LAYER STRUCTURE OF PIEZOELECTRIC PLIES, AND A METHOD FOR PRODUCING IT** the specification of which was filed as PCT International Application number PCT/DE 00/01342 on April 28, 2000.

I hereby state that I believe the named inventor or inventors in this Declaration to be the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365 (b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior foreign application(s):

Priority claimed:

<u>199 28 188.2</u>	<u>GERMANY</u>	<u>JUNE 19, 1999</u>	<u>X</u>	
(Number)	(Country)	(Date filed)	Yes	No
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
(Number)	(Country)	(Date filed)	Yes	No

As a named inventor, I hereby appoint the following attorney to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Michael J. Striker, Reg. No. 27233

Direct all telephone calls to Striker, Striker & Stenby at telephone no.: (631) 549 4700 and address and all correspondence to:

STRIKER, STRIKER & STENBY
103 East Neck Road
Huntington, New York 11743
U.S.A.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statement

may jeopardize the validity of the application or any patent issued thereon.

Signature: <i>Bertram Sugg</i> X <i>Friedrich Boecking</i>	Date: <i>24.09.01</i>	Residence and Full Postal Address: Friedrich-Schaffert-Strasse 8 70839 Gerlingen Germany <i>DEX</i>
Full Name of First or Sole Inventor: Bertram SUGG	Citizenship: GERMAN	
Signature: <i>Friedrich Boecking</i>	Date: <i>14.9.01</i>	Residence and Full Postal Address: Kahlhieb 34 70499 Stuttgart Germany <i>DEX</i>
Full Name of Second Inventor: Friedrich BOECKING	Citizenship: GERMAN	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Third Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Fourth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Fifth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Sixth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Seventh Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Eighth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Ninth Inventor:	Citizenship:	

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